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(54) A fuel pipe

(57) A fuel pipe has an inner tube 32a of non-circular cross-section surrounded by a sheath 34. Fuel flows through the inner tube and any pressure fluctuations in the inner tube result in a flexing of the tube walls to approach more closely to a circular configuration. When the tube walls flex, deformation of the sheath 34 takes place to absorb energy and to prevent the pressure pulse from producing noise. The sheath may be of foam rubber co-extruded with a tube of nylon. The cross-section of the tube may be triangular as shown, tri-lobal (Fig. 3 not shown) or flat (Fig. 4 not shown).

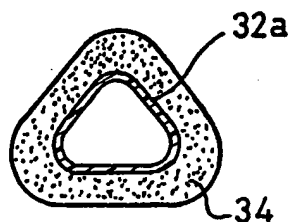


Fig. 2

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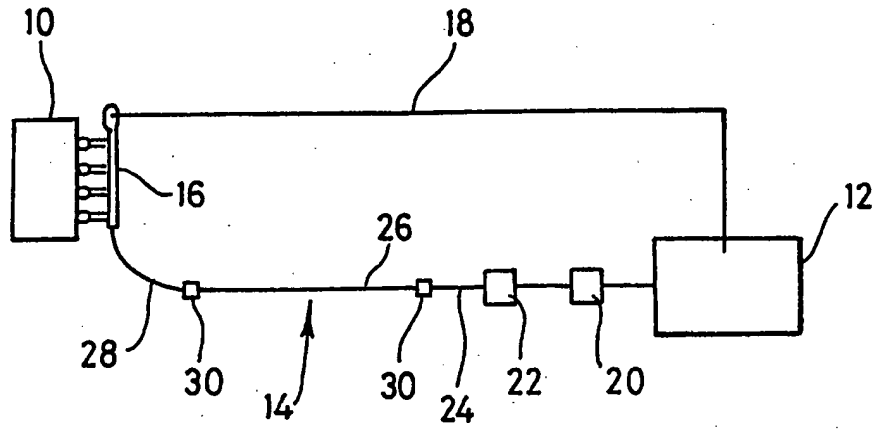


Fig. 1

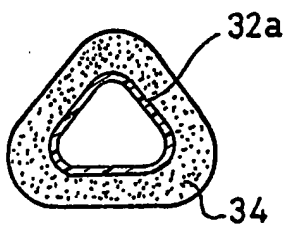


Fig. 2

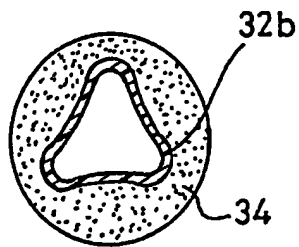


Fig. 3

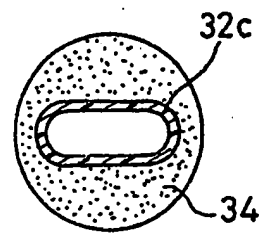


Fig. 4

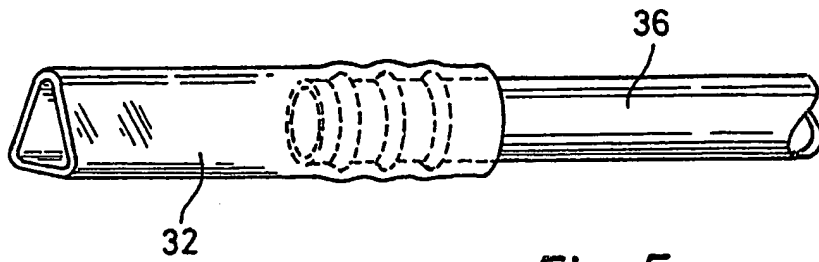


Fig. 5

### A Fuel Pipe

Fuel pipes are used to provide a passage for fuel from the fuel tank to the engine of a motor vehicle. Particularly in  
5 engines which use fuel injection, the fuel passing along the fuel line is subjected to pressure pulses which are the result of the rapid opening and closing of the fuel injectors. These pressure pulses produce undesirable noise from the fuel system.

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It is known to include a pressure surge damper in the fuel line; such dampers conventionally taking the form of a chamber branched off from the fuel line and containing a diaphragm which separates a closed air space from fuel. When a pressure  
15 surge occurs, the diaphragm is forced into the air space and the air is compressed to absorb the energy of the pressure pulse without producing noise. A damper of this type is vulnerable to damage because it sits externally of the fuel line.

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According to the present invention, there is provided a fuel pipe for providing a fuel passage between a fuel tank and a fuel-consuming engine, the pipe comprising an extruded length of flexible plastics tube having a non-circular cross-section.

25

Preferably the tube is surrounded by a rubber or rubber-like sheath which is in contact with the external tube wall. The sheath may or may not be bonded to the external tube wall.

30 A fuel pipe having these features has the capability of expanding its internal volume to accommodate pressure surges. When the tube walls move outward, compression of the rubber takes place and this assists in absorbing energy to avoid the

production of noise.

The tube is preferably of nylon. The sheath may be co-extruded with the tube and preferably has a foamed  
5 structure.

The sheath may be of a synthetic rubber.

Preferably the tube material is sufficiently resilient to  
10 allow it to be fitted over a conventional, circular section, fir-tree spigot to form a connection to the spigot in the same manner as a conventional circular tube.

The invention will now be further described, by way of  
15 example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of an engine fuel system;

20 Figures 2, 3 and 4 are cross-sections through alternative configurations of fuel pipe in accordance with the invention; and

Figure 5 illustrates how a fuel pipe in accordance with  
25 the invention can be fitted to a conventional pipe fitting.

Figure 1 shows an engine 10 which is fed with fuel from a fuel tank 12. The engine is a fuel-injected engine, and fuel is  
30 delivered from the tank 12 along a delivery pipe 14 to a fuel rail 16, and excess fuel is returned to the tank along a return pipe 18. The delivery pipe includes a fuel feed pump 20 and a filter 22. These components may be mounted in the

tank, or may be outside the tank and connected in a section of plastic tubing 24. Where the delivery pipe passes beneath the underside of the vehicle, it may be formed by a section 26 of either steel or plastics tubing, and when the pipe enters the engine compartment, it is formed by a length of pipe 28 in accordance with the invention. The length of this section of pipe can for example be 0.5 m. Conventional connectors are used at 30 to connect the pipe sections 24, 26 and 28.

10 The pipe section 28 comprises a nylon tube 32 surrounded by a rubber-like (eg Santoprene - Registered Trade Mark) sheath 34. Figure 2 shows a tube 32a of generally triangular cross-section; Figure 3 shows a tube 32b of tri-lobal cross-section and Figure 4 shows a tube 32c of flat cross-section. In each case, the tube 32a, 32b, 32c is surrounded by a sheath 34 which has a circular external cross-section and is in contact with the external wall of the tube. The sheath may either be bonded or unbonded to the wall of the tube.

20

In use, when a pressure pulse or pressure surge occurs within the tube 32, the walls of the tube can flex outwards under the pressure to approach a circular configuration. For a given wall length, the space bounded by the wall will be a maximum when the wall is circular, and therefore the internal area (and thus the internal volume of a length of tube) of any of the tube cross-sections shown in Figures 2, 3 and 4 can be increased by this outward flexing of the the tube walls. Note that the tube walls do not have to stretch to achieve this increase in area; they only need to flex.

The sheath 34 around the tube will compress as a result of its rubber-like nature to absorb the energy which has to be

dissipated, but the external surface of the sheathe will not move or change shape, and thus there will be no external air movements which might give rise to undesirable noise.

5 If the tube 32 is of nylon, then it should be possible to stretch it so that it can fit over a conventional, circular, fir-tree fitting as shown at 36 in Figure 5 to provide the necessary seal. In Figure 5 the sheath 34 has been omitted for clarity. As a result, no special end fittings or end  
10 treatment are required for this tube.

The tube 32 can be produced by extrusion using conventional extrusion techniques. The sheath 34 can be co-extruded with the tube 32, or can be manufactured separately and then fitted  
15 over the tube.

The pipe 28 thus described provides a simple and particularly cost-effective manner for preventing pressure pulses in the fuel line from causing undesirable noise. Different engine  
20 installations may have different pressure pulse characteristics in the fuel line, and it would be possible to select the cross-sectional shape and wall thickness of the tube 32 as well as the wall thickness and nature of the sheath 34 in order to tune the pipe 28 to the particular application.  
25

Because the outer surface of the tube 32 is unrestrained, the tube wall only needs to change its configuration, and not to stretch in any way, in order to accommodate the extra volume.

## Claims

1. A fuel pipe for providing a fuel passage between a fuel tank and a fuel-consuming engine, the pipe comprising an  
5 extruded length of flexible plastics tube having a non-circular cross-section.
2. A fuel pipe as claimed in Claim 1, wherein a rubber or rubber-like sheath surrounds the tube and is in contact with  
10 the external tube wall.
3. A fuel pipe as claimed in Claim 1 or Claim 2, wherein the tube is of nylon.
- 15 4. A fuel pipe as claimed in any preceding claim, wherein the sheath is co-extruded with the tube.
5. A fuel pipe as claimed in any preceding claim, wherein the sheath has a foamed structure.
- 20 6. A fuel pipe as claimed in any preceding claim, wherein the sheath is of a synthetic rubber.
7. A fuel pipe as claimed in any preceding claim, wherein  
25 the tube material is sufficiently resilient to allow it to be fitted over a conventional, circular section, fir-tree spigot to form a connection to the spigot in the same manner as a conventional circular tube.
- 30 8. A fuel pipe substantially as herein described with reference to any one embodiment shown in the accompanying drawings.

Relevant Technical fields

- (i) UK CI (Edition K ) F2P (PC1, PC9, PF4, PF5, PF10)  
(PC3, PF23, PF30)
- (ii) Int CL (Edition 5 ) F16L (9/12, 11/12, 55/02,  
55/04) F15D 1/02

Search Examiner

B J PROCTOR

Databases (see over)

(i) UK Patent Office

(ii) ON-LINE DATABASE WPI

Date of Search

10 JUNE 1992

Documents considered relevant following a search in respect of claims

1-7

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1292810 (U.K.E.A.) Eg Figures 2, 3, page 4 lines 13-14	1
Y	GB 1076819 (FORD) Eg page 1 lines 54-60	1, 3, 7
X	GB 1031396 (CONTINENTAL) Eg Figure 3	1, 2, 6
X	EP 0154104 A2 (MEDIPLAST) Eg Figure 2, page 3 lines 1-10	1
X	WO 8404574 A1 (ENITOR) Eg Figure 4, page 2 lines 1-7, page 4 lines 1-7	1



Category	Identity of document and relevant passages	Relevant to claim(s)

#### Categories of documents

**X:** Document indicating lack of novelty or of inventive step.

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**P:** Document published on or after the declared priority date but before the filing date of the present application.

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**&:** Member of the same patent family, corresponding document.

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